

## **Infiltration and Inversion of Holographically-Defined Polymer Photonic Crystal Templates using Atomic Layer Deposition**

J. S. King<sup>1</sup>, E. Graugnard<sup>1</sup>, O. M. Roche<sup>2</sup>, D. N. Sharp<sup>2</sup>, C. J. Summers<sup>1</sup>, R. G. Denning<sup>3</sup>, and A. J. Turberfield<sup>2</sup>

<sup>1</sup>Georgia Institute of Technology, School of Mat. Sci. and Eng., Atlanta, GA, 30332, USA  
<sup>2</sup>University of Oxford, Dept. of Phys.<sup>2</sup>, Inorg. Chem. Laboratory<sup>3</sup>, Oxford, UK

Holographic lithography[1] is a promising fabrication method for 3D photonic crystals. The technique yields sub-micrometre periodic microstructures in polymeric photoresists with low refractive index contrast. Methods for formation of negative replicas of these templates must be compatible with the low decomposition temperature of the resist. Atomic layer deposition of titania (at < 100° C) has been used successfully in the formation of inverse opals [2]. Here we report the realization of 3D photonic crystals by infiltration and subsequent burnout of holographically-defined polymeric templates. We present reflection and transmission spectra for titania/epoxy and titania/air photonic crystals and correlate them with calculated photonic bandstructures. These results demonstrate the effective combination of two powerful techniques to yield unprecedented structural control at the nanoscale in high index 3D photonic crystals.

[1] M. Campbell et al., *Nature* 404, 53 (2000)

[2] J. S. King, et al., *Adv. Mat.*, *in press*.